



GLACIERS

WHAT IS A GLACIER?

Any large mass of snow and ice on the land that persists for many years may be called a glacier. Glaciers are formed where, over a number of years, more snow falls than melts. As this snow accumulates and becomes thicker, it is compressed and changed into dense, solid ice. The mass of snow and ice tends to flow due to its own weight—downhill if it is on a slope or out in all directions from the center if it is on a flat area. The ice in a glacier flows from the area of surplus snow accumulation to the area where yearly melting exceeds accumulation. Where the rate of iceflow balances the rate of icemelt or the rate of calving into the sea, the glacier ends.

CHANGES IN GLACIAL STREAMFLOW

The importance of glaciers as a source of water for use by people stems partly from the fact that the water is stored in winter when the need for irrigation and domestic water is least and becomes available during the heat of midsummer when the need for it is greatest.

Most Americans have never seen a glacier, and most would say that glaciers are rare features found only in inaccessible, isolated wilderness mountains. Are they really so rare? Or are they really potentially important sources of water?

Consider these facts:

- About three-fourths of all the fresh water in the world—equivalent to about 60 years of rain over the entire earth—is stored as glacial ice.
- In North America, the volume of water stored as snow and ice in glaciers is many times greater than that stored in all the lakes, ponds, rivers, and reservoirs on the continent.
- In some states such as Washington and Alaska, glaciers exert an influential—even a dominating—effect on the supply of dry-season water and regulate naturally the streamflow to balance the seasonal and year-to-year variations in precipitation.

GLACIER STATISTICS BY STATE

State	Approximate Number of Glaciers	Total Area of Glaciers in	
		Km ²	(Mi ²)
Alaska	thousands	74,700	(28,842)
Washington	950	420	(162)
California	290	50	(19)
Wyoming	100	50	(19)
Montana	200	42	(16)
Oregon	60	22	(8)
Colorado	25	1.5	(0.6)
Idaho	20	1.5	(0.6)
Nevada	5	0.3	(0.1)
Utah	1	0.1	(0.04)



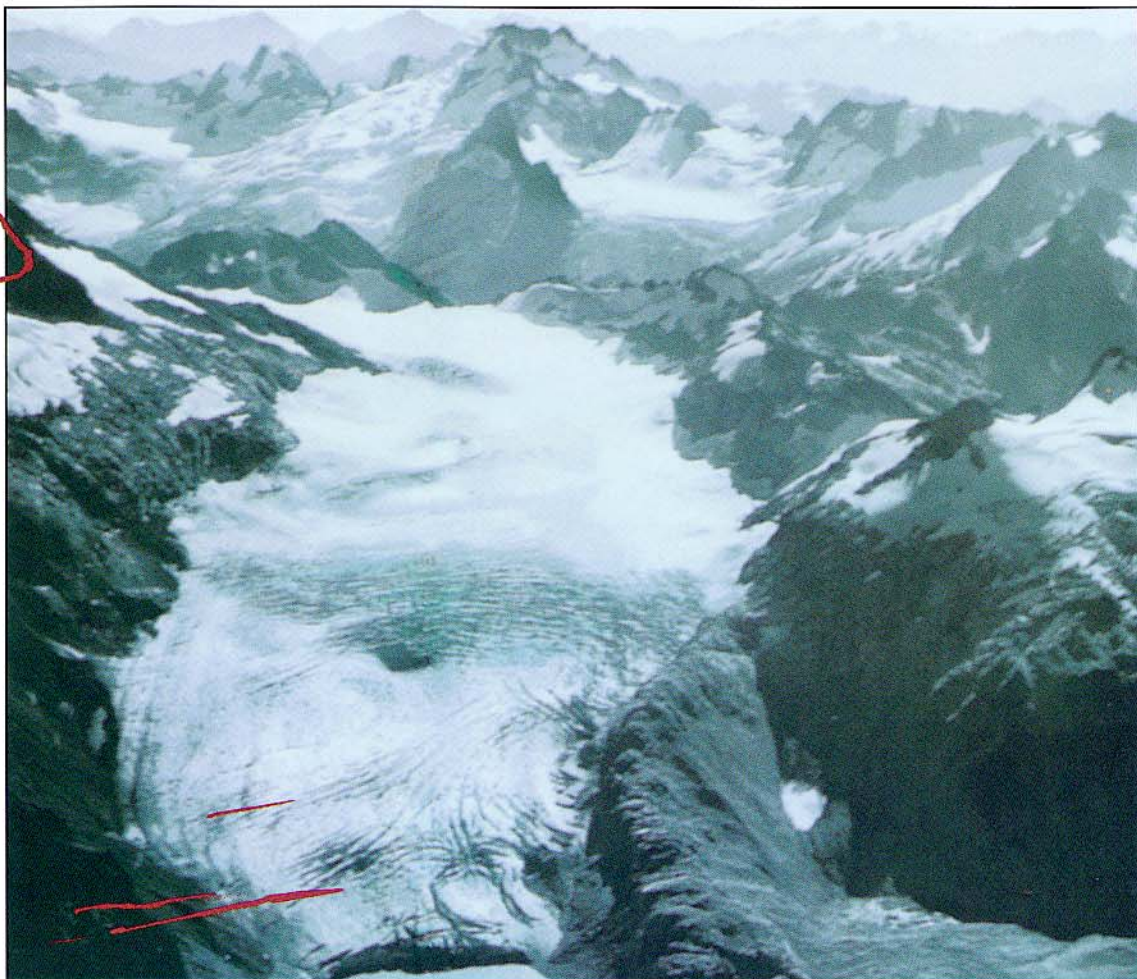
Glacier-fed streamflow not only varies with the season but also changes markedly during a single summer day. Usually the flow reaches a peak in the late afternoon or early evening and a low in the early morning. Icemelt is usually greatest in midday; the delay in the runoff peak is due to the storage and movement of water in the glacier.

THE NATURAL REGULATION OF ICEMELT AND STREAMFLOW

Melting of snow and ice does not depend directly on the warmth of the air or other similar factors. The rate of melt depends on the heat balance at the snow or ice surface. Heat is gained by radiation from the sun, from warm clouds, from warm air, and from the

condensation of dew or frost. Radiation from the sun is usually the main source of heat. Heat is lost by radiation to space, by that required for evaporation, and by the energy that goes into icemelt. If the winter snowpack is unusually heavy, the coating of highly reflective snow persists for a long time over a large area in the summer. This causes more solar radiation to be reflected (a heat loss) and less to be absorbed than during a normal year. Thus, the more snowfall, the less runoff. The converse is also true; the less precipitation, the more runoff. This is opposite of the regime of a nonglacial stream.

In the United States, glaciers are found in Alaska, Washington, California, Wyoming, Montana, Oregon, Colorado, Idaho, Nevada, and Utah.

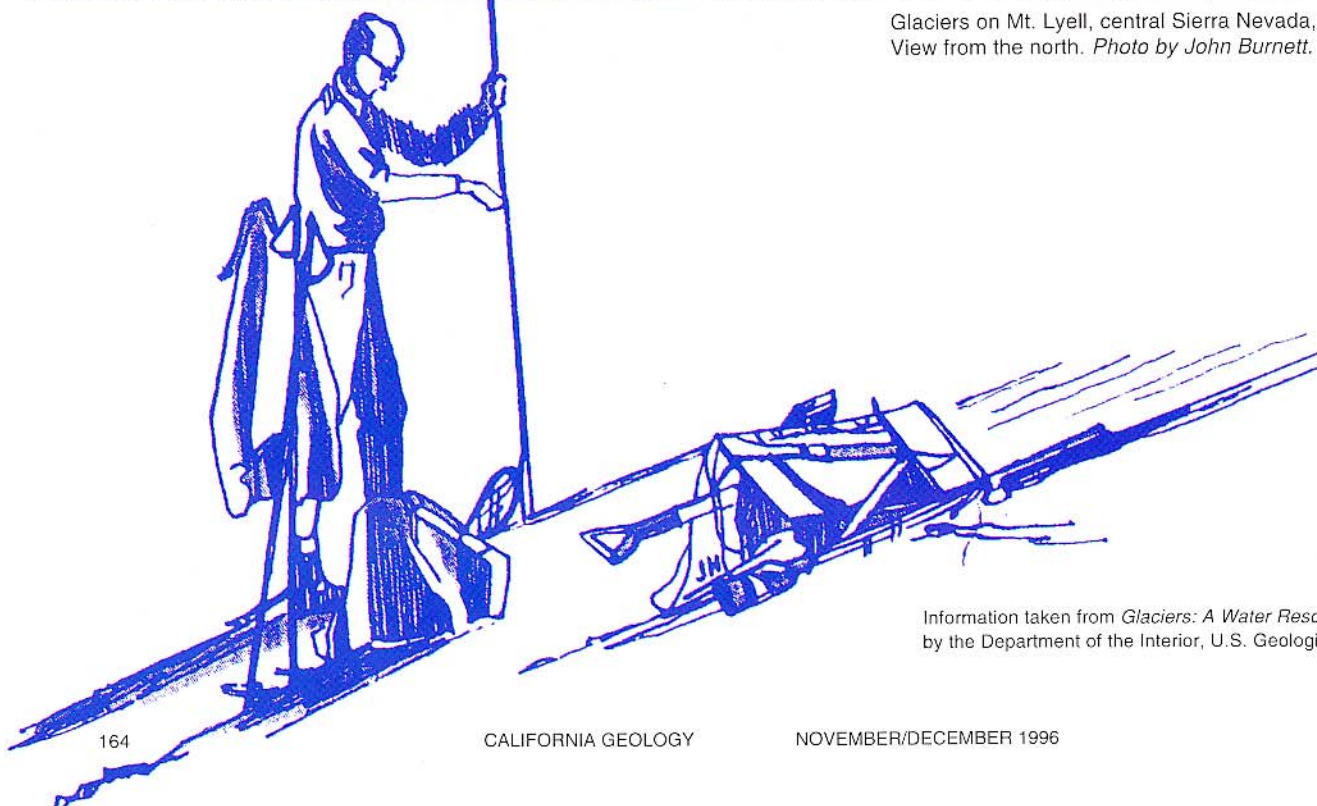


South Cascade Glacier, Washington, as it appeared after abnormal melting due to a long, clear summer. Almost all the winter snow cover had been removed from the glacier surface, and other ice and snow was melting. Considerable frozen water was taken out of storage and released to the stream.

Teacher Feature continued...



Glaciers on Mt. Lyell, central Sierra Nevada, California. View from the north. *Photo by John Burnett.*



Information taken from *Glaciers: A Water Resource* published by the Department of the Interior, U.S. Geological Survey.